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PATENT SPECIFICATION

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(54) PROCESS FOR TREATING COTTON FIBRES

(71) I, FELIX MANOR, an Israeli citizen of 51A Mellor Lane, Mellor, Blackburn, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to a process for treating cotton fibres.

In order to improve the crease resistance of materials made of cotton or cotton blended with other fibres, it has previously been proposed to treat the cotton or blend with a resin. However, although such a resin treatment improves the crease resistance of the material, much of the wear and abrasion resistance is lost, and the tensile strength is considerably reduced.

The present invention has for its object the treatment and resination of cotton fibres whereby the reduction in tensile strength of the cotton fibres is much less than in the previously proposed processes and additionally the abrasion and wear resistance of the cotton is increased.

Accordingly the present invention provides a process for the treatment of cotton fibres comprising extracting at least part of the non-cellulosic substances from the primary wall of the fibres and between the day growth rings underlying the primary wall, mercerizing the fibres in a bath containing a strongly alkaline solution and subsequently treating the fibres with a synthetic resin.

As described in British Patent Specification No. 1,072,798 cotton fibre contains both cellulosic and non-cellulosic materials, the latter being found in the primary wall of the cotton fibre and in the layers between the day growth rings underlying the primary wall. During conventional mercerization the intrafibrillar swelling of the cellulosic macrofibrile tends to shorten and thicken the cellulosic walls and the simultaneous intrafibrillar swelling of the non-cellulosic material causes the distance between the cellulosic lamellae to be widened. If the non-cellulosic material is removed from the cotton fibre the cellulosic lamellae can swell unhindered by the swelling of the non-cellulosic materials. In those circumstances the lamellae are not widely separated but are pressed together and in some instances actually cemented together.

I have discovered that resin finishing or resination of cotton fibres from which non-cellulosic material, as aforesaid, has been removed, proceeds in a manner which is not the same as resination of cotton fibres not so treated. Heretofore resination resulted in the resin penetrating into the less dense interlammellar spaces created during mercerization and this caused the fibres to be stiffened and weakened due to the resin add-on.

If, however, the cellulosic lamellae are close together only a relatively small resin add-on produces equivalent crease resistance. In accordance with the invention, prior to mercerization, at least part of the non-cellulosic substances are extracted from the primary wall of said fibres and between the day growth rings underlying the primary wall.

In extracting the non-cellulosic substances from the primary wall and from the matrix rings between the day growth rings it is preferable to treat the cotton fibre first for an extended period of time in boiling water and then in an alkaline solution having a concentration of less than 0.5%. Preferably, it is subsequently treated in a very weak acid solution and then again in boiling water.

More particularly, according to a preferred embodiment of the invention the fibre is treated in boiling water for a period of 2—8 hours for extraction of part of the wax, gums and slimes and of the water-soluble pectin and protein substances. Then the fibre is treated in a boiling weak alkaline solution, preferably a solution of 0.05% to 0.5% of sodium hydroxide, for a period of 1—4 hours, for dissolving the hemicelluloses. The fibre is then treated in a very weak acid solution, preferably a solu-

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tion of 0.02 to 0.2% of hydrochloric acid, for a period of ¼ to 1 hour for converting protopectins into watersoluble pectins, and is finally treated in boiling water for an additional period of 1 to 3 hours for partial extraction of remaining non-cellulosic substances. Unless otherwise specified, all percentages herein appearing are by weight and all solutions are aqueous.

Following the extraction of the non-cellulosic matrix substances, the cotton fibre is then subjected to a mercerizing bath. If high resilience (i.e. the ability to absorb work without suffering permanent deformation) is desired in the cotton fibre, to permit its use as a stretchable material, the mercerizing step would be performed while the fibre is under slack condition (in accordance with the well known slack mercerizing procedure), so that the microfibrils can freely change from the crystallite alignment into the zigzag form, which causes high shrinkage. Contrary to the usual slack mercerizing process, this change is not hindered by the counteracting force of the matrix swelling.

If the aim of the processing is to reach a high degree of crease resistance, then the mercerizing step is performed under either slack or moderate tension and then the fibres are thereafter tensioned and stretched while the material is still in the presence of the alkaline solution, whereafter the material is neutralized, and can be stretched again after neutralization.

The higher the concentration of the alkaline solution the better crease resistance results. It is particularly preferred to use an alkaline solution which is in the vicinity of its saturation point. The preferred alkali is sodium hydroxide.

The invention may be applied to cotton fibres alone or cotton fibres blended with synthetic fibres.

The following Example illustrates the invention.

EXAMPLE.

Samples of cotton fabric (98 × 62 32/30) were treated to remove from the fibres of at least part of the non-cellulosic substances from the primary wall and/or between the day growth rings and bleached as follows:—

scouring: three hours at 195°F (90½°C) in a bath containing a solution of
1.5% soda ash
1.5 gram per litre wetting agent

bleaching: four hours at 150°F (65½°C) in a bath containing
15 lbs of 50% hydrogen peroxide
15 lbs sodium silicate 29°Tw.
10 lbs soda ash
1¼ lbs wetting agent
water to 75 gallons.

Washing. Cylinder drying.

The fabric was then mercerized and resinated as follows:

Mercerizing: On a chain mercerizing range in caustic soda of about 43% by weight concentration.
Impregnation at moderate tension with shrinkage to 94% of the bleached width.
Restretching while impregnated with alkaline solution to 96%, neutralizing, washing and further restretching on stenter to 103% of the bleached width.

Resin treatment: (Dimethylol hydroxy ethylene urea) from 40 g/l to 280 g/l

Catalyst: Magnesium Chloride
Liquor pick-up 65%
Air dry — cure 3 minutes at 155°C.

The treated samples were tested for crease resistance, tensile strength lbs, tear strength (Elmendorf) and abrasion resistance (Martindale). The results are shown in the following Table I which also shows the results of the same tests applied to the fabric before resination.

Table 1.

Resin g/l	Approximate resin add-on %	Crease resistance angle: DRY warp	DRY weft	WET warp	WET weft	Tensile strength warp	Tensile strength weft	Tear strength Elmendorf warp	Tear strength Elmendorf weft	Abrasion resistance Martindale
Bleached		70	90			62	35		630	8.7
Mercerised		90	90			45	35	840	700	13.5
Resinated:										
40	1.4	105	120	123	110	56	25	1290	900	10.2
60	2.1	115	117	113	120	56	27	1380	964	16.5
80	2.8	125	126	110	100	55	24	1190	836	22.8
100	3.5	120	110	121	115	47	25	1020	750	8.4
120	4.2	127	118	140	135	48	24	960	780	12.3
140	4.9	135	130	124	129	47	22	900	660	20.0
160	5.6	136	129	121	126	46	21	930	660	14.7
180	6.3	142	146	141	139		25		390	13.8
200	7.0	147	148	140	138		27		360	16.7
250	8.75	151	150	137	135		22		420	18.5
280	9.8	156	152	140	139		22		420	1.8

A comparison of the properties of fabric treated in accordance with the invention with conventionally treated fabric and with fabric which has been treated by solvent resination is shown in the following Table 2. In Table 2 columns referenced "A" indicate fabric treated in accordance with the invention, columns "B" conventionally treated fabric and columns "C" fabric after solvent resination treatment. The figures for loss of tensile strength and gain or loss of abrasion resistance were obtained by comparison with the bleached fabric.

Table 2.

Resin add-on % by weight	g/l	Dry crease resistance angle: warp + weft		Loss of tensile strength			Abrasion resistance Martindale		
		A	B	A	B	C	A	B	C
Bleached		160		%	%	%	%	%	%
Mercerized		180					GAIN 139	LOSS	LOSS
1½	40	225	180	29	17	17	17	32	28
2	60	232	190	23	27	22	89	40	37
3	80	251	207	31	39	29	162	54	52
3½	100	230	214	29	41	31		60	58
4	120	245	220	31	43	34	41	65	64
5	140	265	227	37	45	36	129	70	67
5½	160	265	230	40	46	37	69	72	68
6	180	288	234	29	47	38	58	75	70
7	200	295	240	23	49	40	92	81	72
9	250	301	252	37	53	44	112 LOSS	91	76
10	280	308	260	37	55	46	79	97	80

As can be seen from Table 2 the properties of cotton fabric treated in accordance with the invention show remarkably improved properties when compared to fabrics treated by known methods with the same resin add-on.

WHAT I CLAIM IS:—

1. A process for the treatment of cotton fibres comprising extracting at least part of the non-cellulosic substances from the primary wall of the fibres and between the day growth rings underlying the primary wall, mercerizing the fibres in a bath containing a strongly alkaline solution and subsequently treating the fibres with a synthetic resin.

2. A process as claimed in Claim 1, wherein the extraction of non-cellulosic substances is effected by scouring and bleaching.

3. A process as claimed in either preceding claim, wherein the fibres are mercerized under slack conditions.

4. A process as claimed in Claim 3, wherein, after treatment under slack conditions, the fibres are tensioned while in the presence of the alkaline solution.

5. A process as claimed in Claim 1 or Claim 2, wherein the fibres are mercerized while under tension.

6. A process as claimed in any preceding claim, wherein the alkaline solution in said bath is a 43% by weight sodium hydroxide solution.

7. A process as claimed in any one of

Claims 1 to 5, wherein the alkaline solution is present in the vicinity of its saturation point.

8. A process as claimed in any preceding claim, wherein said cotton fibres are blended with synthetic fibres.

9. A process for the treatment of cotton fibres substantially as described herein.

10. Cotton fibres treated by the process as claimed in any preceding claim.

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